

**Listing of Claims:**

Claims 1-3 (**canceled**)

Claim 4 (**currently amended**) An ~~amino acid sequence of an~~ engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase H-protein comprising an amino acid sequence (i) wherein said amino acid sequence of said engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase H protein has at least one a substitution, insertion or deletion of at least one amino acid residue selected from the group consisting of amino acid residues at a position corresponding to residue 108, 111, 114, 133, 134, 138, 162, 193, or and 197 of SEQ ID NO: 47, and (ii) wherein said substitution is of a nonpolar side chain to a different nonpolar side chain, and (iii) wherein said engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase H protein increases long chain fatty acid accumulation has an altered substrate specificity compared to a  $\beta$ -Ketoacyl-acyl carrier protein synthase protein an enzyme having the amino acid sequence at least one unaltered amino acid residue selected from the group consisting of amino acid residues at a position corresponding to residue 108, 111, 114, 133, and 197 of SEQ ID NO: 47.

Claim 5 (**currently amended**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein amino acid sequence of claim 4, wherein said  $\beta$ -Ketoacyl-acyl carrier protein synthase H-protein is obtained from a prokaryotic source.

Claim 6 (**currently amended**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein amino acid sequence of claim 4, wherein said  $\beta$ -Ketoacyl-acyl carrier protein synthase H-protein is obtained from *Escherichia coli*.

Claim 7 (**currently amended**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein amino acid sequence claim 4, wherein said  $\beta$ -Ketoacyl-acyl carrier protein synthase H-protein is obtained from a plant source.

Claims 8-28 (**canceled**)

Claim 29 (**currently amended**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein amino acid sequence of claim 28 4, wherein fatty acid production the specificity

of said engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase H-protein is altered such that ~~long~~ short chain fatty acid accumulation is decreased compared to ~~an enzyme~~ a  $\beta$ -Ketoacyl-acyl carrier protein synthase protein having said at least one unaltered residue ~~the amino acid sequence of SEQ ID NO: 47.~~

Claim 30 (**currently amended**) An ~~amino acid sequence of an engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase H-protein comprising an amino acid sequence (i) wherein said amino acid sequence of said engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase H-protein has a at least one substitution, insertion or deletion of at least one amino acid selected from the group consisting of amino acid residues at a position corresponding to residue 108 and 193 of SEQ ID NO: 47, and (ii) wherein said substitution is of a nonpolar side chain to a different nonpolar side chain, and (iii) wherein said engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase H-protein preferentially catalyzes the formation of accumulates fatty acids having a shorter chain length than fatty acids catalyzed by an enzyme compared to a  $\beta$ -Ketoacyl-acyl carrier protein synthase protein having the amino acid sequence at least one unaltered amino acid residue selected from the group consisting of amino acid residues at a position corresponding to residue 108 and 193 of SEQ ID NO: 47.~~

Claim 31 (**currently amended**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein amino acid sequence of claim 30, wherein said  $\beta$ -Ketoacyl-acyl carrier protein synthase H-protein is obtained from a prokaryotic source.

Claim 32 (**currently amended**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein amino acid sequence of claim 30, wherein said  $\beta$ -Ketoacyl-acyl carrier protein synthase H-protein is obtained from *Escherichia coli*.

Claim 33 (**currently amended**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein amino acid sequence of claim 30, wherein said  $\beta$ -Ketoacyl-acyl carrier protein synthase H-protein is obtained from a plant source.

Claim 34 (**currently amended**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein amino acid sequence of claim 30, wherein fatty acid production ~~the specificity of~~

said engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase II-protein is altered such that long chain fatty acid accumulation is decreased compared to ~~an enzyme a~~  $\beta$ -Ketoacyl-acyl carrier protein synthase protein having said at least one unaltered residue~~the amino acid sequence of SEQ ID NO: 47.~~

Claim 35 (**currently amended**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein amino acid sequence of claim 30, wherein (i) said amino acid residue corresponding to the residue at position 108 of SEQ ID NO: 47 is selected from the group consisting of engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase II protein has an isoleucine, to leucine, and methionine mutation in the amino acid corresponding to amino acid 108 of SEQ ID NO: 47 and wherein (ii) said amino acid residue is substituted with phenylalanine.

Claim 36 (**currently amended**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein amino acid sequence of claim 30, wherein (i) said amino acid residue corresponding to the residue at position 108 of SEQ ID NO: 47 is selected from the group consisting of engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase II protein has an isoleucine and methionine to phenylalanine mutation in the amino acid corresponding to amino acid 108 of SEQ ID NO: 47 and wherein (ii) said amino acid residue is substituted with leucine.

Claim 37 (**currently amended**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein amino acid sequence of claim 30, wherein (i) said amino acid residue corresponding to the residue at position 193 of SEQ ID NO: 47 is selected from the group consisting of engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase II protein has an alanine, phenylalanine, valine, and leucine to isoleucine mutation in the amino acid corresponding to amino acid 193 of SEQ ID NO: 47 and wherein (ii) said amino acid residue is substituted with isoleucine.

Claim 38 (**currently amended**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein amino acid sequence of claim 30, wherein (i) said amino acid residue corresponding to the residue at position 193 of SEQ ID NO: 47 is selected from the group consisting of engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase II protein has an

alanine, phenylalanine, valine, and leucine ~~to methionine mutation in the amino acid~~  
~~corresponding to amino acid 193 of SEQ ID NO: 47~~ and wherein (ii) said amino acid  
residue is substituted with methionine.

Claim 39 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 4, wherein (i) said amino acid residue corresponding to the residue at position 108 of SEQ ID NO: 47 is selected from the group consisting of alanine, valine, leucine, isoleucine, and methionine, and wherein (ii) said amino acid residue is substituted with alanine.

Claim 40 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 4, wherein (i) said amino acid residue corresponding to the residue at position 111 of SEQ ID NO: 47 is selected from the group consisting of phenylalanine, isoleucine, and leucine, and wherein (ii) said amino acid residue is substituted with alanine.

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Claim 41 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 4, wherein (i) said amino acid residue corresponding to the residue at position 114 of SEQ ID NO: 47 is selected from the group consisting of alanine, valine, leucine, isoleucine, and methionine, and wherein (ii) said amino acid residue is substituted with alanine.

Claim 42 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 4, wherein (i) said amino acid residue corresponding to the residue at position 133 of SEQ ID NO: 47 is selected from the group consisting of phenylalanine and isoleucine, and leucine and wherein (ii) said amino acid residue is substituted with alanine.

Claim 43 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 4, wherein (i) said amino acid residue corresponding to the residue at position 197 of SEQ ID NO: 47 is selected from the group consisting of leucine and isoleucine and wherein (ii) said amino acid residue is substituted with alanine.

Claim 44 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 4, wherein said engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein accumulates

normal membrane components compared to a  $\beta$ -Ketoacyl-acyl carrier protein synthase protein having said at least one unaltered residue.

Claim 45 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 4, wherein said engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein accumulates longer than normal membrane components compared to a  $\beta$ -Ketoacyl-acyl carrier protein synthase protein having said at least one unaltered residue.

Claim 46 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 4, wherein said engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein is more specific for the synthesis of eight carbon fatty acids compared to a  $\beta$ -Ketoacyl-acyl carrier protein synthase protein having said at least one unaltered residue.

Claim 47 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 4, wherein said engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein (i) has an alanine substitution at positions corresponding to residues 108, 111, and 114 of SEQ ID NO: 47 and (ii) wherein said engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein synthesizes longer carbon chain fatty acids in transgenic plants compared to wild-type plants.

Claim 48 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 4, wherein said engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein (i) has an alanine substitution at positions corresponding to residues 108, 111, and 114 of SEQ ID NO: 47 and (ii) wherein said engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein synthesizes longer carbon chain fatty acids in transgenic plants compared to a  $\beta$ -Ketoacyl-acyl carrier protein synthase protein having said at least one unaltered residue in transgenic plants.

Claim 49 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 4, wherein said engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein (i) has an alanine substitution at positions corresponding to residues 108, 111, 114, 133, 197 of SEQ ID NO: 47 and (ii) wherein said engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase

protein synthesizes longer carbon chain fatty acids in transgenic plants compared to wild-type plants.

Claim 50 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 4, wherein said engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein (i) has an alanine substitution at positions corresponding to residues 108, 111, 114, 133, 197 of SEQ ID NO: 47 and (ii) wherein said engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein synthesizes longer carbon chain fatty acids in transgenic plants compared to a  $\beta$ -Ketoacyl-acyl carrier protein synthase protein having said at least one unaltered residue in transgenic plants.

Claim 51 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 30, wherein said engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein has a reduced ability to utilize C8-ACP and longer substrates for condensation while still able to use the C6-ACP for elongation to produce C8 fatty acids.

Claim 52 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 30, wherein said engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein has an increased ability to utilize C6-ACP substrates for elongation compared to a  $\beta$ -Ketoacyl-acyl carrier protein synthase protein having said at least one unaltered residue.

Claim 53 (**new**) An engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein comprising an amino acid sequence (i) wherein said amino acid sequence of said engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein has a substitution of at least one amino acid residue selected from the group consisting of amino acid residues at a position corresponding to residue 108, 134, 193, 202 and 342 of SEQ ID NO: 47, and (ii) wherein said substitution is of a nonpolar side chain to a smaller nonpolar side chain, and (iii) wherein said engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein has an altered elongator molecule preference compared to a  $\beta$ -Ketoacyl-acyl carrier protein synthase protein having at least one unaltered amino acid residue selected from the group consisting of amino acid residues at a position corresponding to residue 108, 134, 193, 202 and 342 of SEQ ID NO: 47.

Claim 54 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 53, wherein said  $\beta$ -Ketoacyl-acyl carrier protein synthase protein is obtained from a prokaryotic source.

Claim 55 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 53, wherein said  $\beta$ -Ketoacyl-acyl carrier protein synthase protein is obtained from *Escherichia coli*.

Claim 56 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 53, wherein said  $\beta$ -Ketoacyl-acyl carrier protein synthase protein is obtained from a plant source.

Claim 57 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 53, wherein said elongator molecule is a molecule other than Malonyl-ACP.

Claim 58 (**new**) The amino acid sequence of claim 53, wherein said engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein produces a branched chained fatty acid.

Claim 59 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 53, wherein (i) said amino acid residue corresponding to the residue at position 108 of SEQ ID NO: 47 is selected from the group consisting of alanine, valine, leucine, isoleucine, and methionine, and wherein (ii) said amino acid residue is substituted with glycine.

Claim 60 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 53, wherein (i) said amino acid residue corresponding to the residue at position 134 of SEQ ID NO: 47 is selected from the group consisting of valine and isoleucine and wherein (ii) said amino acid residue is substituted with glycine.

Claim 61 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 53, wherein (i) said amino acid residue corresponding to the residue at position 134 of SEQ ID NO: 47 is selected from the group consisting of valine and isoleucine and wherein (ii) said amino acid residue is substituted with alanine.

Claim 62 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 53, wherein (i) said amino acid residue corresponding to the residue at position 193 of SEQ ID NO: 47 is selected from the group consisting of alanine, phenylalanine, valine, and leucine and wherein (ii) said amino acid residue is substituted with glycine.

Claim 63 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 53, wherein (i) said amino acid residue corresponding to the residue at position 202 of SEQ ID NO: 47 is a phenylalanine and wherein (ii) said phenylalanine is substituted with an amino acid residue selected from the group consisting of isoleucine, leucine, and glycine.

Claim 64 (**new**) The engineered  $\beta$ -Ketoacyl-acyl carrier protein synthase protein of claim 53, wherein (i) said amino acid residue corresponding to the residue at position 342 of SEQ ID NO: 47 is a leucine and wherein (ii) said leucine is substituted with an amino acid residue selected from the group consisting of alanine and glycine.